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Cascaded multi-dithering technique for high power beam combination setup

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Coherent beam combination is a way to obtain high power by coherently adding lower power beam elements and has been highlighted as an alternative to scale up the power of high power and high beam quality lasers which has faced several problems such as thermal effect and nonlinear effects. For combining a large number of beam elements, It is inevitable to use active phase control, which is to lock phases of beam elements and obtain maximum output power. There are several methods in active phase control such as heterodyne detection, stochastic parallel gradient descent (SPGD) algorithm, multi-dithering technique, and single-dithering technique. Among those methods, locking of optical coherence by single detector electronic-frequency tagging (LOCSET) technique, as known as multi-dithering technique, locks the phases of beam elements by modulating the phases with different frequencies and demodulating the signal of the combined beam with those frequencies. It has showed excellent performance in terms of phase stability and the number of beam elements to be combined. However, the maximum number of beam elements to be combined is limited up to 100 to 200 when combining high-power amplified beam elements using LOCSET, since the number of modulating frequencies is limited 100 to 200 because of the constraint of the control bandwidth of phase locking system. Cascaded Multi-Dithering (CMD) technique has been proposed to solve this limitation, by modulating beam elements in series and combining them as a form of array. It was successfully demonstrated by combining sixteen beam elements in 2015. Nevertheless, CMD technique also has a limit to combine high-power amplified beam elements because of low damage threshold of phase modulators which dither high power beam elements after amplification. In this paper, a new setup of CMD technique for high power beam combination is presented. By simply changing the configuration of CMD technique, the problem of low damage threshold of phase modulators is easily solved, which enhances the capability of CMD technique as a powerful tool for combining a substantial number of high power beam elements.

Biography

Hee Kyung Ahn has completed his PhD from Korea Advanced Institute of Science and Technology (KAIST) and Post-doctoral studies from Korea Research Institute of Standard and Science (KRISS).

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